



HOSPITAL  
SAN MARCOS



# Chapter I

## Natural Disasters and Health Facilities

### 1. Introduction

Major natural disasters in the last two decades have affected at least 800 million people worldwide, causing thousands of deaths, as well as economic losses of more than 50 billion dollars.<sup>1</sup> Growing population density in several regions of the planet—and the consequent settlement of high-risk areas—are likely to make matters worse. In Latin America and the Caribbean, hundreds of health installations were severely damaged by the action of natural phenomena. Earthquakes, floods, landslides, hurricanes, among others, caused severe damage not only to the infrastructure, but also the loss of human lives and the interruption of the operation of health facilities, whose function is imperative, even more so during critical times.

*Tables 1.1 through 1.3* show some of the effects of adverse natural phenomena on health infrastructure.

Adverse natural phenomena affect health systems' operations both directly and indirectly.<sup>2</sup>

- $\Sigma$  Direct effects include:
  - Damaged health care facilities;
  - Damaged infrastructure across the locality (including the destruction of access roads), leading to the breakdown of public services that are indispensable to health facility operations.
- Indirect effects include:
  - An unexpected number of deaths, injuries, or disease outbreaks in the affected community, exceeding the capacity of the local healthcare network to provide treatment;
  - Spontaneous or organized migrations away from the affected area towards other areas where health system capacity may be overwhelmed by the new arrivals;

1 Noji, E. *The Public Health Consequences of Disasters*, Oxford University Press, 1997.

2 Adapted from E. Noji, *The Public Health Consequences of Disasters*, Oxford University Press, 1997.

- Increases in the potential risk of a critical outbreak of communicable diseases, and an increase in the risk for psychological diseases among the affected population;
- Food shortages leading to malnutrition and weakened resistance to various diseases.

**Table 1.1 Effects of hurricanes on health systems**

| Location and event                       | Year | Nature of the phenomenon | Overall effects  |
|--|------|--------------------------|--|
| Jamaica, Hurricane Gilbert               | 1988 | Category 5               | Twenty-four hospitals and health centers damaged or destroyed; 5,085 patient beds lost.  |
| Costa Rica and Nicaragua, Hurricane Joan | 1988 | Category 4               | Four hospitals and health centers damaged or destroyed.  |
| Dominican Republic, Hurricane Georges    | 1998 | Category 3               | Eighty-seven hospitals and health centers damaged or destroyed.  |
| Saint Kitts and Nevis, Hurricane Georges | 1998 | Category 3               | Joseph N. France Hospital in Saint Kitts suffered severe damage; 170 beds lost.  |
| Honduras, Hurricane Mitch                | 1998 | Category 5               | Seventy-eight hospitals and health centers damaged or destroyed.<br>Honduras' national health network severely affected and rendered inoperative just as over 100,000 people needed medical attention. |
| Nicaragua, Hurricane Mitch               | 1998 | Category 5               | One-hundred eight hospitals and health centers damaged or destroyed.   |

Sources: Based on *Natural Disasters: Protecting the Public Health*, Scientific Publication No. 575, Pan American Health Organization, 2000; *Health in the Americas*, 2002 Edition, Volume I, Pan American Health Organization, 2002.

Table 1.2 Effects of floods on health systems

| Location                                   | Date      | Nature of the phenomenon                      | Overall effects  |
|--|-----------|---|--|
| Pacific and Andean Region of South America | 1997-1998 | Floods associated with the El Niño phenomenon | The floods stressed the health system's ability to combat acute respiratory infections, acute diarrheal diseases, vector-borne diseases (malaria, classic dengue, hemorrhagic dengue, yellow fever, encephalitis, Chagas' disease, etc.), water- and food-borne diseases (cholera, salmonellosis, typhoid fever, viral hepatitis, multiple intestinal parasitism, etc.) and skin diseases (scabies, bacterial infections and mycoses, etc.). |
| Ecuador                                    | 1997-1998 | Floods associated with the El Niño phenomenon | Thirty-four hospitals, 13 health centers and 45 secondary health centers affected, either in their infrastructure, installations or equipment. Chone Hospital, not yet inaugurated at the time of the flooding, suffered severe losses in medical equipment, furnishings, supplies and drugs.  |
| Peru                                       | 1997-1998 | Floods associated with the El Niño phenomenon | Fifteen hospitals, 192 health centers and 348 health posts affected.   |
| Bolivia                                    | 2002      | Hail and heavy rains                          | Fifty-seven dead. Functional and structural collapse of the Policonsultorio de la Caja Nacional.   |
| Argentina                                  | 2003      | Flooding due to rivers overflowing            | Severe damage to Dr. Alassia's Children's Hospital and the Vera Candiotti Rehabilitation Hospital, as well as to 14 health centers of the 49 that serve Health Area V in Argentina.  |

Sources: *Crónicas de Desastres N° 8: Fenómeno El Niño 1997-1998*, Pan American Health Organization, 2000;

*Health in the Americas*, 2002 Edition, Volume I, Pan American Health Organization, 2002.

*Las Lecciones de El Niño, Ecuador*, Corporación Andina de Fomento, 2000.

*Las Lecciones de El Niño, Perú*, Corporación Andina de Fomento, 2000

PAHO/WHO Bolivia website. [www.ps.org.bo](http://www.ps.org.bo), 2 February 2004

*Evaluación del impacto de las inundaciones y el desbordamiento del río Salada en la provincia de Santa Fe, República de Argentina en 2003*, Report of ECLAC, LC/BUEL/L.185, June, 2003.

**Table 1.3 Effects of earthquakes on health facilities**

| Location                  | Date | Magnitude | Overall effects   |
|---------------------------|------|-----------|---|
| San Fernando, California  | 1971 | 6.4       | Three hospitals suffered severe damage and were unable to operate normally when they were most needed. Most of the disaster-related deaths and injuries occurred in the two hospitals that collapsed. Olive View Hospital, one of the most severely affected, had to be demolished and rebuilt. Since this was done in the traditional fashion, however, the new Olive View Hospital facilities suffered severe nonstructural damage in the earthquake of 1994, disrupting functions.   |
| Managua, Nicaragua        | 1972 | 7.2       | The General Hospital was severely damaged. It had to be evacuated and, subsequently, demolished.  |
| Guatemala City, Guatemala | 1976 | 7.5       | Several hospitals required evacuation.  |
| Popayán, Colombia         | 1983 | 5.5       | Damage and interruption of services at the San José University Hospital.  |
| Chile                     | 1985 | 7.8       | Seventy nine hospitals and health centers damaged or destroyed; 3,271 beds lost.  |
| Mendoza, Argentina        | 1985 | 6.2       | Over 10 percent of the hospital beds in the city were lost. Of the 10 facilities affected, one had to be evacuated; two were subsequently demolished.   |
| Mexico City, Mexico       | 1985 | 8.1       | Structural collapse of five hospital facilities and major damage to another 22. At least 11 facilities had to be evacuated. Direct losses estimated at US\$640 million. The hospitals that suffered the most damage were the National Medical Center of the Mexican Social Security Institute (IMSS), the General Hospital, and Benito Juárez Hospital. Between the patient beds destroyed and those taken out of service due to evacuation, the seismic event caused a sudden deficit of 5,829 beds. At the General Hospital, 295 died; at the Juárez Hospital, 561 died. Among the casualties were patients, doctors, nurses, administrative staff, visitors, and newborns. |
| San Salvador, El Salvador | 1986 | 5.4       | Over 11 hospital facilities affected; 10 had to be evacuated and one was condemned; 2,000 beds were lost. Total damage was estimated at US\$97 million.   |
| Tena, Ecuador             | 1995 | 6.2       | Velasco Ibarra Hospital (120 beds) suffered moderate non-structural damage—cracking on several walls, breaking of glass windows, collapse of false ceilings, elevator system failure, and damage to water and oxygen pipes—forcing evacuation of the facilities.  |

Continued  
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**Table 1.3 Effects of earthquakes on health facilities (continued)**

| Location          | Date | Magnitude | Efectos generales  |
|-------------------|------|-----------|--|
| Aiquile, Bolivia  | 1998 | 6.8       | Carmen López Hospital severely damaged.  |
| Armenia, Colombia | 1999 | 5.8       | Sixty-one health facilities damaged.   |
| El Salvador       | 2001 | 7.6       | The earthquake caused 1,917 hospital beds (39.1 percent of the country's total capacity) to be put out of service. Severely damaged San Rafael Hospital continued to provide some services outdoors, on the hospital grounds. Rosales Hospital lost its capacity to provide surgical services as a result of damage to several key wings. San Juan de Dios (San Miguel) and San Pedro (Usulután) Hospitals were severely damaged and provided partial services out of doors. The Oncology Hospital had to be completely evacuated. |
| Peru              | 2001 | 6.9       | Seven hospitals, 80 health centers and 150 health posts were affected in the Departments of Arequipa, Moquegua, Tacna and Ayacucho   |

Sources: Based on *Principles for Natural Disaster Mitigation in Health Facilities*, Pan American Health Organization, 2000.  
*Natural Disasters: Protecting the Public Health*, Scientific Publication No. 575, Pan American Health Organization, 2000.  
*Health in the Americas*, 2002 Edition, Volume I, Pan American Health Organization, 2002.  
 "Daños observados en los hospitales de la red de salud asistencial de El Salvador en el terremoto del 13 de Enero of 2001, Informe preliminar," Boroschek and Retamales, 2001.  
 Regional Health Directorates of Arequipa, Moquegua, Tacna and Ayacucho, Peru (July 17, 2001).

Table 1.4 lists the most common effects of the natural hazards considered in this handbook.

**Table 1.4 Effects of various natural hazards**

| Effect  | Earth-<br>quakes   | Strong<br>winds | Tsunamis<br>and flash<br>floods | Slow-onset<br>flooding        | Landslides              | Volcanoes<br>and lahar<br>activity        |
|---|--|-----------------|---------------------------------|-------------------------------|-------------------------|---|
| Loss of lives                                       | High   | Low             | High                            | Low                           | High                    | High                                      |
| Severe injuries<br>requiring com-<br>plex treatment | High   | Moderate        | Low                             | Low                           | Low                     | Low                                       |
| Major risk of<br>communicable<br>diseases           | Potential risk following all significant events (the likelihood increases with crowding and the degradation of sanitary conditions). |                 |                                 |                               |                         |   |
| Damage to<br>health facilities                      | Severe<br>(struc-<br>tural and<br>equip-<br>ment)  | Severe          | Severe but<br>localized         | Severe<br>(equipment<br>only) | Severe but<br>localized | Severe (struc-<br>tural and<br>equipment) |
| Damage to<br>water supply<br>systems                | Severe   | Leve            | Severe                          | Leve                          | Severe but<br>localized | Severe (struc-<br>tural and<br>equipment) |
| Food scarcity                                       | Infrequent (generally<br>caused by economic<br>or logistical factors)  |                 | Common                          | Common                        | Infrequent              | Infrequent                                |
| Major popula-<br>tion movement                      | Infrequent (common<br>in severely affected<br>urban areas)   |                 | Common<br>(generally limited)   |                               |                         |   |

Source: *Vigilancia epidemiológica sanitaria en situaciones de desastre, guías para el nivel local*, Organización Panamericana de la Salud, 2002.

The interruption of a health facility's operations after a disaster may be short-term (hours or days), or long-term (months and years). It all depends on the magnitude of the event and its effects on the health sector. The magnitude of an event cannot be controlled; its consequences, however, can be.

When planning a future health facility, the effects of these phenomena can be controlled if site selection is guided by sound information and criteria, and the design, construction, and maintenance can withstand local hazards. In the south of Chile, for instance, the main hospital for the

city of Concepción managed to continue operating in spite of being near the epicenter of the country's most devastating earthquake of the twentieth century, which took place on 21 and 22 May 1960.

Failures are more widely publicized than successes, but the Concepción case is by no means unique. Another example worth noting is the different behavior of two neighboring hospitals hit by the Northridge, California earthquake of 1994. The first, USC Medical Center Hospital, had been designed with a base-isolation seismic-protection system. Not only did the buildings suffer no structural damage, but none of the equipment or key contents were damaged in the earthquake, and the facility remained in operation throughout the crisis and beyond. The adjacent facility had been designed and built according to traditional standards. Damage to it was so severe it could not continue to operate, and was eventually demolished.

## 2. Economic aspects

Reports by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) state unequivocally that natural disasters are a significant obstacle to the economic and social development of countries in the Americas. While adverse natural phenomena do not discriminate between industrialized and developing countries, their consequences can be very different. In 1998, for instance, 95 percent of the deaths associated with natural disasters took place in developing countries. Adverse natural phenomena are far more likely to devastate the population's standard of living and their development prospects. By contrast, natural phenomena generally affect only marginally the economy and population of developed countries.<sup>3</sup> (See *Table 1.5*)

The effects of a natural disaster are amplified in the health sector, for three reasons. First, it is one of the sectors that tends to suffer important economic losses in such situations, given the significant investments required. Second, its recovery also implies large outlays, difficult to procure at a time when the rest of the country is also trying to recover. Finally, it needs to quickly recover its capacity, not only to continue meeting the normal demand for its services, but also to care for the population directly affected by the event.

3 ECLAC/IDB, *A Matter of Development: How to Reduce Vulnerability in the Face of Natural Disasters*, 2000.

**Table 1.5 Effect of natural disasters on national economies**

| Location           | Eventt                                  | Date      | Effect on the economy  |
|--------------------|---|-----------|--|
| Managua            | Earthquake                              | 1972      | Decline of 15 percent in GDP and 46 percent in Managua's industrial and productive activity. |
| México             | Earthquake                              | 1985      | GDP fell by 2.7 percent  |
| Nicaragua          | Hurricane Joan                          | 1988      | GDP suffered 2 percent reduction; 17 percent decline in the agricultural sector.             |
| Ecuador            | Floods caused by the El Niño phenomenon | 1997-1998 | GDP growth 1.2 percent lower than expected in 1998.  |
| Dominican Republic | Hurricane Georges                       | 1998      | GDP reduction of 1 percent compared to annual forecast.                                      |
| Nicaragua          | Hurricane Mitch                         | 1998      | GDP growth of 4 percent, 1.1 points lower than forecast for that year.                       |
| Honduras           | Hurricane Mitch                         | 1998      | Fall in GDP of 7.5 percent.  |
| El Salvador        | Earthquakes                             | 2001      | The damages that resulted represent 12 percent of the country's GDP the previous year        |

Source: ECLAC/IDB, *A Matter of Development: How to Reduce Vulnerability in the Face of Natural Disasters*, prepared for the "Confronting Natural Disasters: A Matter of Development" Seminar, 2000.

### 3. Mitigating vulnerability to disasters in health facilities

In recent years, following the disasters caused by Hurricane Mitch and the El Salvador earthquakes, several countries, among them Argentina, Bolivia, Chile, Colombia, Costa Rica, Honduras and Peru, and international institutions such as PAHO/WHO, ECLAC, the Inter-American Development Bank (IDB) and the World Bank, have begun to raise awareness on the need to promote strategies for mitigating vulnerability and managing the risks facing health systems in the region. Considerable progress has been made in the field of disaster education in medicine and nursing faculties, and in schools of architecture and engineering. The lessons learned reveal that most losses in health infrastructure are due to location in vulnerable areas, inadequate design, or the lack of proper maintenance. While most efforts in the 1990s focused on assessing

and reducing the vulnerability of existing health facilities, in recent years there has been an increase in investment in new facilities based on solid criteria for protecting infrastructure and operations. In Chile, for instance, it has been mandatory since 1999 for project consultancy groups to include specialists in hospital vulnerability. They are responsible for ensuring that protection criteria are incorporated in the design and construction of new health infrastructure.

The Pan American Health Organization (PAHO), through its Public Health in the Americas initiative, has defined a set of Essential Public Health Functions (EPHF). Aimed at the health authorities of the region at all levels—central, intermediate, and local—they set the foundation for evaluating the current healthcare situation, improving public health practices, and strengthening the leadership of health authorities.

Among the essential functions agreed upon in June 2000, during the 126th session of PAHO's Executive Committee, is reducing the impact of emergencies and disasters on health, which is to be achieved through the following actions:<sup>4</sup>

- Planning and executing public health policies and activities on prevention, mitigation, preparedness, response, and early rehabilitation;
- Providing an integrated focus addressing the causes and consequences of all possible emergencies or disasters that can affect a country;
- Encouraging the participation of the entire health system, as well as the broadest possible intersectoral and inter-institutional cooperation, in reducing the impact of emergencies and disasters; and
- Promoting intersectoral and international cooperation in finding solutions to the health problems caused by emergencies and disasters.

4 World Health Organization (WHO), *Public Health in the Americas: New Concepts, Performance Analysis and Bases for Action*, Scientific and Technical Publication N° 589, 2002.